Space Weather Technical Forecast

Issued on Thursday, 17 February 2022 at 12:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with a couple of minor C-class flares which appear to have originated from AR2941, which transited to the far side through the 16th, but was classified as Eki / Beta-Gamma before it did. This leaves seven sunspot regions on the visible disc. AR2948 in the southeast is the most noteworthy of these. It has grown slightly in longitudinal length, but the majority of its intermediary spots have decayed. It is currently classified as Dsi/Beta. All other regions are currently small and simple alpha or beta regions.
No Earth-directed CMEs were in evidence in available coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, has been at slow-ambient levels, currently around 370 km/s. The density was average between around 3 and 8 pp. The IMF has been weak throughout, with a peak of 7 nT, while the north-south component ranged from +3 to -7nT. The phi angle started negative (towards the sun) with a switch around 17/0200 UTC to positive (away from the sun) .The net result of the above solar wind measures was Quiet to Unsettled (Kp 1-3) geomagnetic activity..

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was slightly raised for a time, but mostly near at background levels, with a peak of 1.3 pfu observed at 16/1420 UTC. This was probably due to the large CME which occurred on the far side late on the 15th.
The high energy electron flux (greater than 2MeV) was at High (>1000 pfu) levels through much of the period, with a peak of 9020 pfu at 16/1630 UTC. It has subsequently declined and dropped below the High level at 16/2200 UTC. The corresponding 24-hour integrated electron fluence has declined slowly and remains above the 1e8 Active level, with a reading of 2.81e8 integrated pfu at 17/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Low through the forecast period, with C-class flares likely (60%) and a slight chance (10%) of an M-class flare, most likely during the remainder of day 1 (17th) whilst 2941 remains close to the west limb on the far side.

Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast period. Solar winds are likely to remain slow-ambient until later on day 3 (9th) with a chance of winds becoming slightly elevated or elevated due to a high speed stream (HSS) related to CH55/-. If this was to happen Quiet geomagnetic activity would likely become Unsettled to Active, and there would be a slight chance of a G1 / Minor geomagnetic storm.

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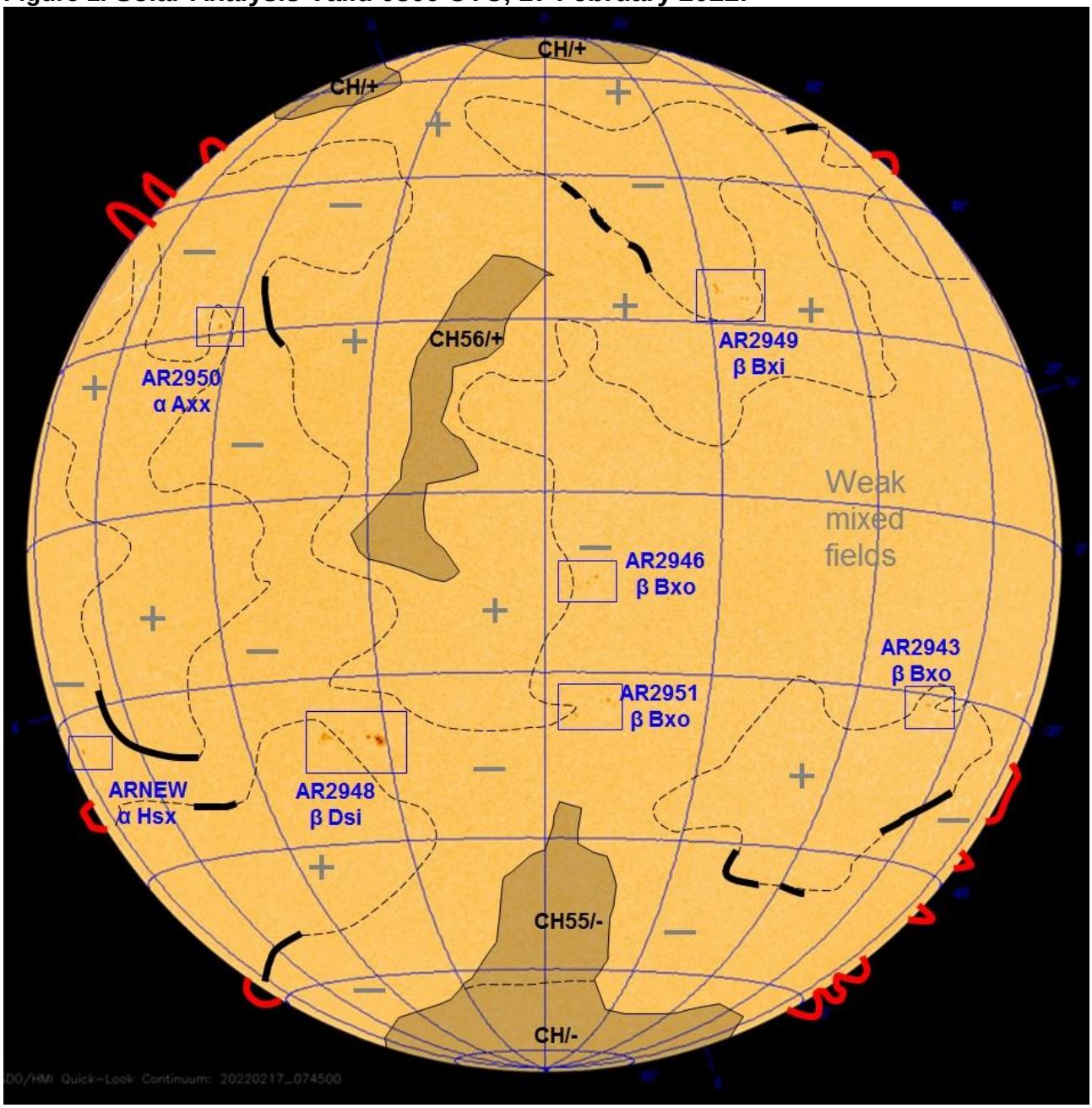
Energetic Particles / Solar Radiation: The high energy proton flux is expected to remain at background levels during the period. The High (>1000 pfu) electron flux and corresponding Active (>1e8 integrated pfu) electron fluence is likely to gradually decrease to background levels over the next couple of days under the influence of a slow wind regime.

Figure 1. Solar Analysis Valid 0800 UTC, 17 February 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

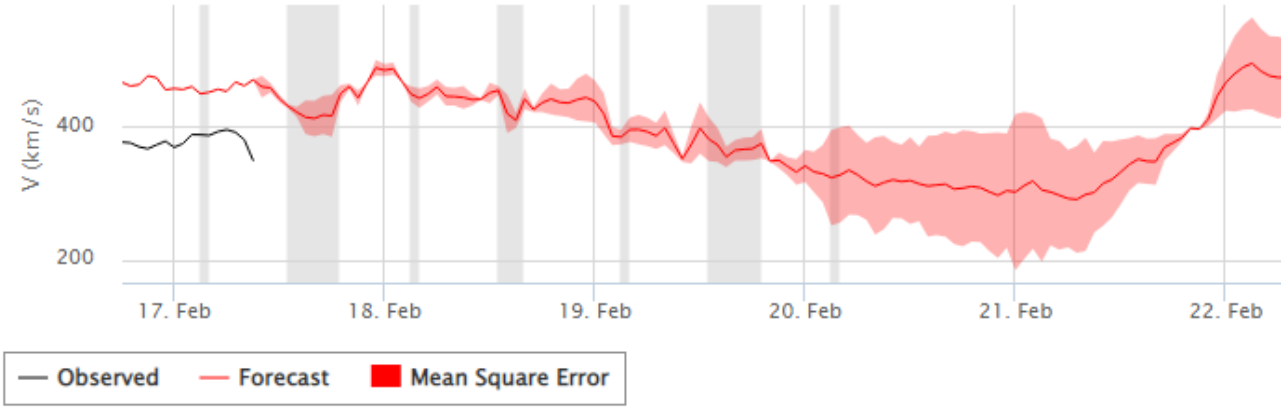
No Earth-directed CMEs feature in this forecast at present.
Solar winds are currently at slow-ambient levels. Quiet geomagnetic activity for days and 2 (17th and 18th) with isolated Unsettled spells during any sustained periods of negative BZ. However, later on day 3 (19th) into day 4 (20th) there is a chance that Earth will connect to the high speed stream from negative coronal hole 55 (CH55/-), which is an extension of the southern crown. If this was to happen elevated solar winds would likely result in Unsettled to Active geomagnetic activity, with a chance of a G1 / Minor geomagnetic storm.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office Solar Winds Prediction Model (SWPM) indicating a waning solar wind over the next few days with a possible enhancement on 19th absent from model output.



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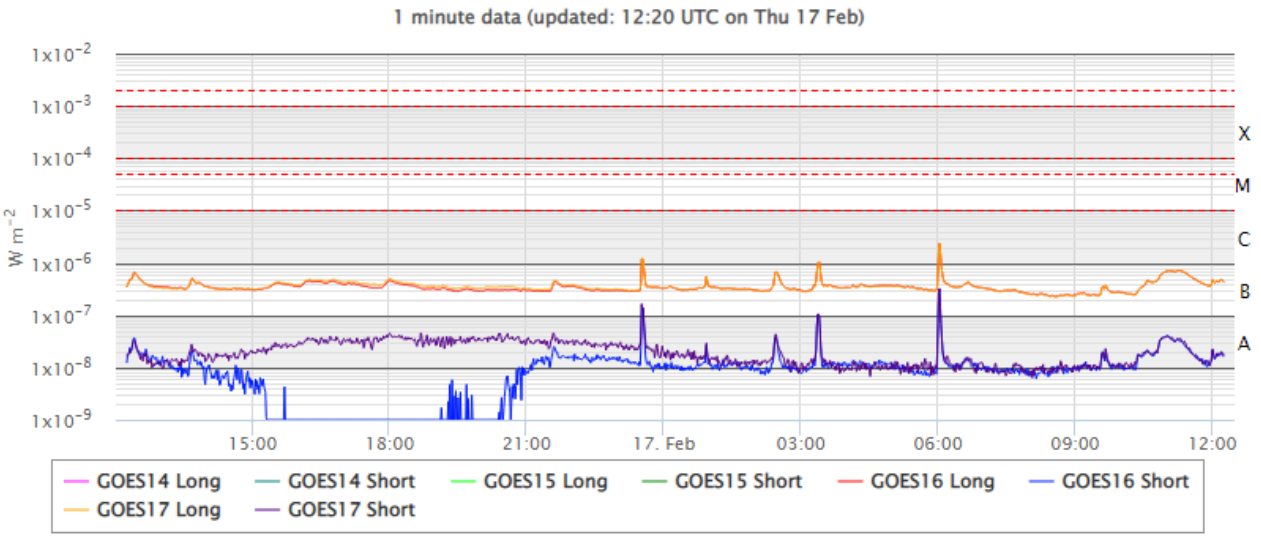
Radio Blackouts - X-Ray Flares:

There are currently 7 active sunspot regions on the Earth facing disc, after 2941 transited to the far side during the 16th. 2941 was previously the largest and most active region on the disc, with the majority of the remaining regions on disc small and simple alpha or beta regions. However, AR2948 in the southeast, and approaching centre-disc, is rather more developed and is classified Dsi/Beta. There is also the potential that EX2936 may rotate round the eastern limb later in the period, although no obviously bright region is visible on STEREO-EUVI at the time of writing.

Solar activity is currently at Low levels over the past 24 hours, after the two minor C-class flares, and further flares of this class are likely with a 60% probability. There is a slight chance (10%) of an M-class flare. This is most likely on day 1 (17th) whilst 2941 remains near the western limb on the far side. Otherwise, 2948 is the most probable candidate for any significant flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	5	5	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot at GEO with C-class flares indicated over the past 24 hours.



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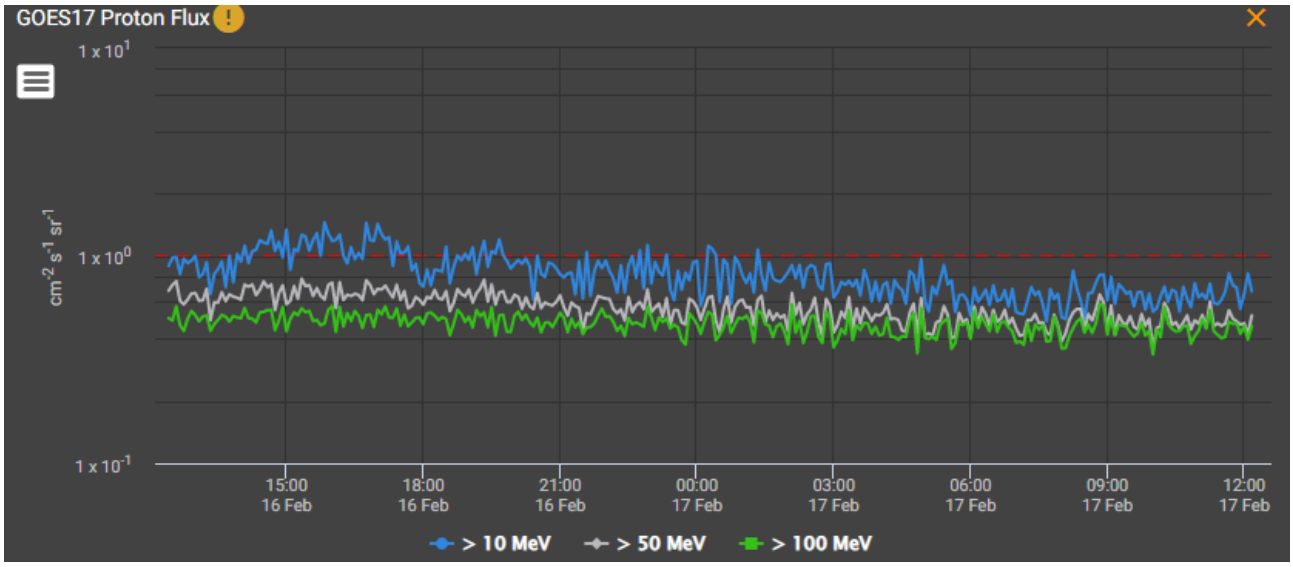
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux, as measured by GOES-16 is at background levels. Solar radiation storms are not expected in the period, however there is a very slight chance on day 1 (17th) whilst 2941 remains near the western limb on the far side.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES 17 Proton Flux with slightly raised levels around 16/1500 UTC.



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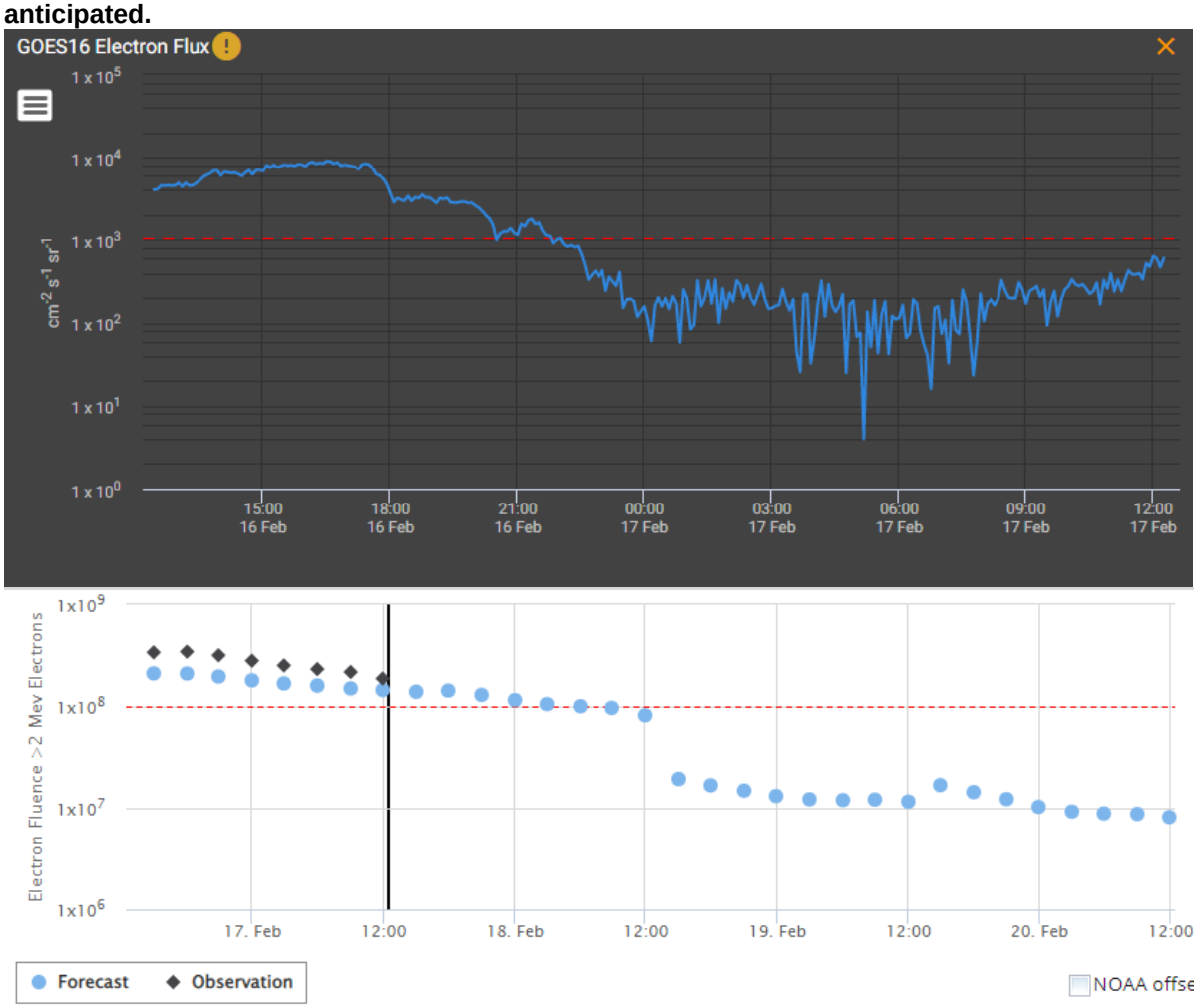
High Energy Electrons Event (≥ 2MeV):
Electron flux reached High levels (>1000pfu) yesterday (16th) and the corresponding fluence is above the Active (1e8 integrated pfu) threshold. Over the next couple of days these should steadily decrease to background levels, under the influence of a slow wind regime, with REFM output offering good guidance. The possibility of increased geomagnetic activity later in the week would also aid in the reduction.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	70	40	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux and Met Office REFM output with a general lowering in activity anticipated.



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